

U.S. Patent Application No. 09/620,162
Docket No. 249 DIV

In response, applicant cancels herein, claims 6, 17, 19 and 21, and amends claims 14 and 27 to correct minor typographical errors. Accordingly, applicant respectfully requests the objections of claims 6, 14, 17, 19, 21 and 27 be withdrawn.

Rejection of Claim Under 35 U.S.C. § 112 First Paragraph

In the May 9, 2002 Office Action, claim 27 was rejected under 35 U.S.C. § 112 first paragraph, because the claim recites open ended language, specifically that a manganate material "has a Curie temperature above 273 K".

In response, applicant amends herein claim 27 to encompass a temperature range that is between 273 K and 334 K. Such amendment is fully supported by data provided in Table II of the instant specification and on the basis of such amendment, claim 27 is enabling within the meaning of 35 U.S.C. § 112 and as such applicant respectfully requests the rejection be withdrawn.

Rejection of Claims Under 35 U.S.C. § 112 Second Paragraph

In the May 9, 2002 Office Action claim 27 was rejected under 35 U.S.C. § 112 second paragraph, because the term "thin" is not defined by the claim.

In response, applicant amends herein claim 27 to delete the limitation "thin film" and as such removes the limitation, which is considered indefinite.

Based on such amendments, claim 27 is definite within the meaning of 35 U.S.C. § 112 second paragraph. Accordingly, applicants respectfully request the rejection of such claim be withdrawn.

Rejection of Claims Under 35 U.S.C. § 103(a)

In the May 9, 2002 Office Action, claims 1-4, 6-22 and 27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of U.S. Patent No. 5,487,356 (hereinafter referred to as "Li") and U.S. Patent No. 6,060,420 (hereinafter referred to as "Munakata").

Li, is directed to a chemical vapor deposition method of forming films showing a giant magnetoresistance, wherein such films are described as $(La_{1-x}A_x)MnO_3$, where $x + y = 1$. Li, further discloses that films having the formula $(La_{0.72}Ca_{0.28})MnO_3$ are known in the art to exhibit a GMR effect and have been previously deposited by PVD methods.

Applicant's invention, is directed to a method of making A-site deficient manganate materials having the general formula $\text{La}_x\text{M}_y\text{MnO}_3$, where $\text{M} = \text{Mg}, \text{Ca}, \text{Sr}, \text{or Ba}$, and $0.5 < (x+y) < 0.9$. Claim 1 and claims 2-5, 7-17, 19, 21, 27 and 28, which depend therefrom, therefore demarcate manganate materials in a different compositional regime than that of the magnetoresistive film material of Li.

When determining differences between the prior art and the claimed invention, it is necessary for the Examiner to consider applicant's invention as a whole, which provides a CVD method of forming magnetoresistive materials having the general formula $\text{La}_x\text{M}_y\text{MnO}_3$, where $\text{M} = \text{Mg}, \text{Ca}, \text{Sr}, \text{or Ba}$, and $0.5 < (x+y) < 0.9$ and Curie temperatures that are at or above room temperature. Applicant's invention solves a need in the art for such materials having room temperature, Curie temperatures and a method of making such materials. Li, does not solve such a problem, nor does Li suggest, understand or expect that by making a material that is A-site deficient, the Curie temperature of a magnetoresistive film would rise to, at, or above room temperature.

Li provides no derivative basis for the applicant's claimed invention, since Li is broadly directed to a method of making metal oxides of the formula $\text{La}_x\text{A}_{1-x}\text{MnO}_3$, wherein the corresponding value of $(x + y)$ is 1. In other words, Li is directed to a method of making stoichiometrically regular films. Li therefore teaches away from applicant's claimed invention wherein $(x + y)$ is in the range of between 0.5 and 0.9.

The Examiner states in Item 15 of the May 9, 2002 Office Action:

Regarding amended independent claim 1, Li et al. teach the applicant's claimed method for depositing manganate films having the general formula $(\text{La}_{1-x}\text{A}_x)\text{MnO}_3$, wherein A is selected from the group consisting of Ba, Ca, Mn, and Sr.

The Examiner then confirms in the very next sentence that applicant's invention is in fact different from Li, et al.

(i.e., films identical to the films claimed by the applicant except for the A-site deficiency (i.e., an "x+y" value of greater than 0.5 and less than 0.9).

Consequently, Li et al, does not teach applicant's invention.

The Examiner further states in Section 25 of the instant Office Action:

U.S. Patent Application No. 09/620,162
Docket No. 249 DIV

In addition, the applicant argues that there is no motivation in the art to move in the direction of the applicant's claimed process for making magnetoresistive materials having a Curie temperature that is at or above room temperature. Rather, the examiner has asserted that the materials reasonably suggested by Munakata et al., (and formed by the method of Li et al.) would inherently possess the applicant's claimed invention Curie temperature value(s), as the Curie temperature appears to be a property that is inherent to a given material, and Munakata et al. reasonably suggest the applicant's claimed manganate materials.

Applicant traverses the Examiner's assertion. The mere fact that the CVD method as taught by Li et al., could be used to produce the A-site deficient films of the instant invention does not give cause to deprive the inventors the true value of their inventive skill. Myriad techniques and chemistries may be used to deposit thin films having A-site deficient component stoichiometry (i.e., physical vapor deposition, sol-gel, sputtering, evaporation). However, only through inventive insight could the inventor's of the instant invention discover:

1. that: reducing the concentration of an A-site component in a manganate material increases the RT_{max} ;
2. that the ratio of M/La is critical to obtaining RT_{max} ;
3. that the variance in (La+M):Mn ratio has a greater influence on T_c than M/La; and
4. the method conditions under which to obtain 1-3.

Films deposited by alternative methods will possess varying degrees of crystallinity, porosity, defects etc. and it is only in hindsight that any combination of Li and Munakata is made.

The Examiner is assuming that because a portion of the component stoichiometry of applicants' claimed A-site deficient films falls within the component stoichiometry disclosed by Munakata, that Munakata, renders obvious applicant's claimed method for making A-site deficient manganate materials. The Examiner further specifies that Munakata et al., suggest an "A-site filling value" of as low as 0.8, which is within the instant claimed range of 0.5 to 0.9.

In fact, Munakata teaches away from applicant's component stoichiometry by disclosing at column 4, lines 57-68:

When the A-site defect amount α is $0 < \alpha < 0.2$, the stabilization of perovskite structure is attained and also the introduction of oxygen vacancy playing an important role for the catalytic action is promoted by the valency control through A-site defect. On the other hand, when the oxygen vacancy amount δ is $0 \leq \delta \leq 1$, the perovskite structure is most stable and the maintenance of oxygen desorption and absorption performance and the improvement of durability can be realized. If the A-site defect amount α is not less than 0.2, a precipitation amount of a secondary phase undesirably increases to considerably degrade oxygen desorption and absorption performance of the composite oxide. Preferably, α is $0.1 < \alpha < 0.15$. In the latter case, the oxygen desorption and absorption performance is considerably improved at a temperature region of not higher than 700.degree. C., but if the value of α becomes not less than 0.15, the precipitation of the secondary phase is apt to be started to make the perovskite structure unstable.

In such demarcated stoichiometric regime, the manganate materials of applicant's invention achieve remarkably high Curie temperatures, as set out in Table 2 on pages 17 and 18. As stated in the sentence bridging pages 4 and 5 of the instant application, the manganate films of the present invention "exhibit Curie temperatures at or above room temperature and therefore are technologically valuable and a significant advance in the art."

Munakata teaches composite oxides of A-site defect type perovskite structure, particularly A-site defect type perovskite composite oxides suitable for use in catalysts and electrode materials which control a solid phase reaction to improve the durability and thermal resistance and can move oxygen vacancy produced through valency control in crystal lattices at a high speed.

What motivation is there to combine Li's method of making GMR stoichiometrically regular films with the A-site defect type perovskite composites of Munakata, which are useful for transporting electrons/oxygen at high temperatures (i.e. 700°C), to arrive at a method of making A-site deficient GMR materials having Curie temperatures at or above room temperature. Both Munakata and Li are absent of any suggestion and/or teaching to deposit by CVD, A-site deficient manganate materials having an "x+y" value of greater than 0.5 and less than 0.9, as heretofore, such films were unknown. The Examiner must show that a skilled artisan confronted with the problem of raising the Curie temperature of GMR films, with no knowledge of the claimed invention, would select the combination of Li and Munakata.

U.S. Patent Application No. 09/620,162
Docket No. 249 DIV

On such basis of the foregoing, claims 1-5, 7-17, 19, 21, and 27 are fully patentably distinguished over Li and Munakata under 35 U.S.C. § 103(a). Applicant respectfully requests the withdrawal of such rejection and reconsideration of claims 1-5, 7-17, 19, 21, and 27.

In the May 9, 2002 Office Action, claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of U.S. Patent No. 5,487,356 (hereinafter referred to as "Li") and U.S. Patent No. 6,060,420 (hereinafter referred to as "Munakata") and in further view of U.S. Patent No. 6,010,969 (hereinafter referred to as "Vaartstra") and U.S. Patent No. 5,659,101 (hereinafter referred to as "Biagini").

Li and Munakata are delineated hereinabove. Vaartstra, is directed to a chemical vapor deposition method of depositing films useful in semiconductor applications from carboxylate complexes. More particularly, Vaartstra teaches a chemical vapor deposition method of forming dielectric materials for memory devices in semiconductor integrated circuits. Vaartstra further teaches that the carboxylate complexes may comprise any one or more metals from the Periodic Table's Groups IVB, VB, 1A, IIA, IIIA, IVA, VA, VIA, IIIB and the lanthanides. Such broad teaching encompasses some 58 elements, all of which may theoretically form carboxylate complexes. Vaartstra specifically discloses only the metals Ba, Sr, Nb, Ta, Ti and Bi.

Biagini is directed to a catalytic system to polymerize diolefinic monomers. Various compositions having the formula ML_3 are disclosed wherein L may be pivalate, acetylacetonate and/or hexafluoroacetylacetonate.

The Examiner reasons that Li and Munakata teach all the limitations of applicant's claim 5, except for the use of metal pivalate Lewis base adduct precursors and that use of such precursors would have been obvious to one of ordinary skill in the art in light of Vaartstra and Biagini.

Absent applicant's instant patent application, there is no teaching, suggestion or motivation in the art as a whole or the references, to combine Li, Munakata and Vaartstra and/or Biagini to arrive at applicant's claimed method for making magnetoresistive materials having a Curie temperature that is at or above room temperature. In fact, Munakata, Vaartstra and Biagini are directed to solving very different problems (i.e., catalyst and high dielectric films) and there is no suggestion in any one or all of the references that would lead one skilled in the art to combine their teachings to arrive at a method of depositing manganate materials that are deficient in A-site component for

U.S. Patent Application No. 09/620,162
Docket No. 249 DIV

the purpose of raising the material's Curie temperature. The prior art does not contain the knowledge of applicant's invention and such combination is only possible in hindsight.

Accordingly, and based on the foregoing, applicants respectfully request the withdrawal of the rejection of claim 5 under 35 U.S.C. §103(a).

Fee Payable For Added Claim 28

The addition of new dependent claim 28 does not increase the total number of claims beyond the number previously paid for at the time of filing the application. Accordingly, applicant does not believe that any fee is due in connection with the entry of this Amendment, however, if it is determined that a fee or charge is properly payable, the same is hereby authorized to be charged to Deposit Account No. 50-0860 of Advanced Technology Materials, Inc.

CONCLUSION

With this amendment and addition of dependent claim 28, all issues of allowability of the instant application are respectfully submitted to be resolved favorably to applicant.

It therefore is requested that the Examiner responsively issue a Notice of Allowability for claims 1-5, 7-17, 19, 21, 27 and 28, so that the application can be passed to issue at an early date.

If any issues remain, incident to formal allowance of the application, the Examiner is requested to contact the undersigned agent at (203) 794-1100 ext 4184 to resolve same.

Respectfully submitted,



Maggie Chappuis
Agent for Applicant
Registration No. 45,735

Advanced Technology Materials Inc.
7 Commerce Drive
Danbury CT 06810
Telephone (203) 794-1100 ext 4184
Facsimile (203) 797-2544
Docket No. ATMI 249 DIV